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Title
A BUILDING BLOCK FORMING A C-C OR C-HETERO ATOM BOND UPON REACTION.

- 5 Technical Field of the Invention**
- The present invention relates to a building block comprising a complementing element and a precursor for a functional entity. The building block is designed to transfer the functional entity precursor with an adjustable efficiency to a recipient reactive group upon recognition between the complementing element and an encoding element associated with the reactive group. The invention also relates to a method for transferring a functional entity precursor to recipient a reactive group.
- Background**
- The transfer of a chemical entity from one mono-, di- or oligonucleotide to another has been considered in the prior art. Thus, N. M. Chung et al. (Biochim. Biophys. Acta, 1971, 228, 536-543) used a poly(U) template to catalyse the transfer of an acetyl group from 3'-O-acetyladenosine to the 5'-OH of adenosine. The reverse transfer, i.e. the transfer of the acetyl group from a 5'-O-acetyladenosine to a 3'-OH group of another adenosine, was also demonstrated.
- Walder et al. Proc. Natl. Acad. Sci. USA, 1978, 75, 51-55 suggest a synthetic procedure for peptide synthesis. The synthesis involves the transfer of nascent immobilized polypeptide attached to an oligonucleotide strand to a precursor amino acid attached to an oligonucleotide. The transfer comprises the chemical attack of the amino group of the amino acid precursor on the substitution labile peptidyl ester, which in turn results in an acyl transfer. It is suggested to attach the amino acid precursor to the 5' end of an oligonucleotide with a thio ester linkage.
- The transfer of a peptide from one oligonucleotide to another using a template is disclosed in Bruylants RK et al. Chemistry & Biology, 1996, 3:49-56. The carboxy terminal of the peptide is initially converted to a thioester group and subsequently transformed to an activated thioester upon incubation with Ellman's reagent. The activated thioester is reacted with a first oligo, which is 5'-thiol-terminated, resulting in the formation of a thio-ester linked intermediate. The first oligonucleotide and a
- (54) Title: A BUILDING BLOCK FORMING A C-C OR C-HETERO ATOM BOND UPON REACTION
- (57) Abstract: A building block having the dual capabilities of transferring genetic information and functional entity precursor to a recipient reactive group is disclosed. The building block may be used in the generation of a single complex or libraries of different complexes, wherein the complex comprises an encoded molecule linked to an encoding element. Libraries of complexes are useful in the quest for pharmaceutically active compounds.

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second oligonucleotide having a 3' amino group is aligned on a template such that the thioester group and the amino group are positioned in close proximity and a transfer is effected resulting in a coupling of the peptide to the second oligonucleotide through an amide bond.

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Summary of the Invention

The present invention relates to a building block of the general formula:

Complementing Element - Linker - Carrier - C-F-connecting group - Functional entity precursor

10 capable of transferring a Functional entity precursor to a recipient reactive group, wherein

Complementing Element is a group identifying the Functional entity precursor, **Linker** is a chemical moiety comprising a spacer and a **S-C-connecting** group, wherein the spacer is a valence bond or a group distancing the Functional entity precursor to be transferred from the complementing element and the **S-C-connecting** group connects the spacer with the **Carrier**.

Carrier is arylene, heteroarylene, C₂-C₆ alkenylene, C₁-C₆ alkynylene, C₁-C₆ alkylenes, or -(CF₂)_m- substituted with 0-3 R' wherein m is an integer between 1 and 10;

R' are independently selected from -H, -OR², -NR², -Halogen, -NO₂, -CN, -C(Halogen)₃, -C(O)R², -C(O)NR², C(O)NR², -NC(O)R², -S(O)NR², -S(O)NR², -S(O)R², -P(O)R², -P(O)R², -S(O)-R², P(O)-OR², -S(O)-OR², -N'R³, wherein R' is H, C₁-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl, or aryl,

C-F-connecting group is chosen from the group consisting of -SO₂O-, -O-SO₂O-, -C(O)-O-, -S'(R'R'R), -C-U-C(V)-O-, -P'(W)-O-, -P(W)-O- where U is -C(R²)₂, -NR²- or -O-, V is =O or =NR² and W is -OR² or -N(R²)₂,

Functional entity precursor is -C(H)R³)R⁴ or functional entity precursor is heteroaryl or aryl optionally substituted with one or more substituents belonging to the group comprising R³ and R⁴.

Wherein R³ and R⁴ independently is H, alkyl, alkenyl, alkynyl, cycloalkyl, cycloheteroalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of SnR⁵R⁶R⁷, Sn(OR⁵)R⁶R⁷, Sn(OR⁵)(OR⁶)R⁷, Br⁶R⁷, Br⁶R⁷, B(OR⁶)², B(OR⁶)(OR⁷), halogen, CN, CNO, C(halogen)₃,

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OR⁶, OC(=O)R⁶, OC(=O)OR⁶, OC(=O)NR⁶R⁶, SR⁵, S(=O)R⁶, S(=O)R⁶, S(=O)₂NR⁶R⁶, NO₂, N₃, NR⁶R⁶, N'R'R⁶R⁷, NR⁶NR⁶R⁷, NR⁶NR⁶R⁸, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R⁷, NC, P(=O)(OR⁵)OR⁶, P'R⁵R'R⁷, C(=O)R⁶, C(=O)NR⁵R⁶, C(=O)OR⁶, C(=O)NR⁵OR⁶, C(=O)NR⁵OR⁶,

wherein, R⁶, R⁶, and R⁷ independently is H, alkyl, alkenyl, alkynyl, cycloalkyl, cycloheteroalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of halogen, CN, CNO, C(halogen)₃, =O, OR⁸, OC(=O)OR⁸, OC(=O)NR⁸R⁸, SR⁸, S(=O)R⁸, S(=O)R⁸, S(=O)₂R⁸, S(=O)₂NR⁸R⁸, NO₂, N₃, NR⁸R⁸, N'R⁸R⁸R¹⁰, NR⁸OR⁸, NR⁸C(=O)R⁸, NR⁸C(=O)NR⁸R¹⁰, NC, P(=O)(OR⁸)OR⁸, P'R⁸R⁸R⁷, C(=O)R⁸, C(=O)NR⁸R⁸, C(=O)NR⁸R⁸, C(=O)NR⁸R⁸, C(=O)NR⁵R⁸, C(=O)NR⁵NR⁸R¹⁰, wherein R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁸ may together form a 3-8 membered heterocyclic ring or R⁸ and R⁷ may together form a 3-8 membered heterocyclic ring,

wherein,

R⁸, R⁸, and R¹⁰ independently is H, alkyl, alkenyl, alkynyl, cycloalkyl, cycloheteroalkyl, aryl or heteroaryl and wherein R⁸ and R¹⁰ may together form a 3-8 membered heterocyclic ring or R⁸ and R¹⁰ may together form a 3-8 membered heterocyclic ring or R⁸ and R¹⁰ may together form a 3-8 membered heterocyclic ring.

In the present description and claims, the direction of connections between the various components of a building block should be read left to right. For example an **S-C-connecting group** -C(=O)-NH- is connected to a **Spacer** through the carbon atom on the left and to a **Carrier** through the nitrogen atom on the right hand side.

10 The term "C₃-C₇ cycloheteroalkyl" as used herein refers to a radical of totally saturated heterocycle like a cyclic hydrocarbon containing one or more heteroatoms selected from nitrogen, oxygen, phosphorus, boron and sulphur independently in the cycle such as pyrrolidine (1- pyrrolidine; 2- pyrrolidine; 3- pyrrolidine; 4- pyrrolidine; 5- pyrrolidine); pyrazolidine (1- pyrazolidine; 2- pyrazolidine; 3- pyrazolidine; 4- pyrazolidine; 5- pyrazolidine); imidazolidine (1- imidazolidine; 2- imida-

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zolidine; 3-imidazolidine; 4-imidazolidine; 5-imidazolidine); thiazolidine (2-thiazolidine; 3-thiazolidine; 4-thiazolidine; 5-thiazolidine); piperidine (1-piperidine; 2-piperidine; 3-piperidine; 4-piperidine; 5-piperidine; 6-piperidine); piperazine (1-piperazine; 2-piperazine; 3-piperazine; 4-piperazine; 5-piperazine; 6-piperazine); morpholine (2-morpholine; 3-morpholine; 4-morpholine; 5-morpholine; 6-morpholine); thiomorpholine (2-thiomorpholine; 3-thiomorpholine; 4-thiomorpholine; 5-thiomorpholine; 6-thiomorpholine); 1,2-oxathiolane (3-(1,2-oxathiolane); 4-(1,2-oxathiolane); 5-(1,2-oxathiolane); 1,3-dioxolane (2-(1,3-dioxolane); 4-(1,3-dioxolane); 5-(1,3-dioxolane); tetrahydropyran; 2-tetrahydropyran; 3-tetrahydropyran; 4-tetrahydropyran; 5-tetrahydropyran; 6-tetrahydropyran); hexahydropyridazine (1-(hexahydropyridazine); 2-(hexahydropyridazine); 3-(hexahydropyridazine); 4-(hexahydropyridazine); 5-(hexahydropyridazine); 6-(hexahydropyridazine); 1,3,2-dioxaborolane, [1,3,6,2]dioxaborocane

The term "aryl" as used herein includes carbocyclic aromatic ring systems of 5-7 carbon atoms. Aryl is also intended to include the partially hydrogenated derivatives of the carbocyclic systems as well as up to four fused fused aromatic- or partially hydrogenated rings, each ring comprising 5-7 carbon atoms.

The term "heteroaryl" as used herein includes heterocyclic unsaturated ring systems containing, in addition to 2-18 carbon atoms, one or more heteroatoms selected from nitrogen, oxygen and sulphur such as furyl, thiienyl, pyrrolyl, heteroaryl is also intended to include the partially hydrogenated derivatives of the heterocyclic sys-

The terms "aryl" and "heteroaryl" as used herein refers to an aryl which can be optional groups enumerated below.

tionally substituted or a heteroaryl which can be optionally substituted and includes phenyl, biphenyl, indenyl, naphthyl (1-naphthyl, 2-naphthyl), N-hydroxytetrazolyl, N-hydroxytriazolyl, N-hydroxymimidazolyl, anthracenyl (1-anthracenyl, 2-anthracenyl, 3-anthracenyl), thiophenyl (2-thienyl, 3-thienyl), furyl (2-furyl, 3-furyl), indolyl, oxadiazolyl, isoxazolyl, quinazolinyl, fluorenyl, xanthenyl, isohindanyl, benzhydryl, acridinyl, thiazolyl, pyrrolyl (2-pyrrolyl), pyrazolyl (3-pyrazolyl), imidazolyl (1-imidazolyl, 2-imidazolyl, 4-imidazolyl, 5-imidazolyl), triazolyl (1,2,3-triazol-1-yl, 1,2,3-triazol-2-yl, 1,2,3-triazol-4-yl, 1,2,4-triazol-3-yl), oxazolyl (2-oxazolyl, 4-oxazolyl, 5-oxazolyl), thiazolyl (2-thiazolyl, 4-thiazolyl, 5-thiazolyl), pyridyl (2-pyridyl, 3-pyridyl, 4-pyridyl), pyrimidinyl (2-pyrimidinyl, 4-pyrimidinyl, 5-pyrimidinyl, 6-pyrimidinyl), purazinyl, puridazinyl (3-puridazinyl, 4-puridazinyl, 5-puridazinyl, 6-puridazinyl), purazinyl, puridazinyl (3-puridazinyl, 4-puridazinyl).

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1	pyridazinyl, 5-pyridazinyl), quinolyl (2-quinolyl, 3-quinolyl, 4-quinolyl, 5-quinolyl, 6-quinolyl, 7-quinolyl, 8-quinolyl), isoquinolyl (1-isoquinolyl, 3-isoquinolyl, 4-isoquinolyl, 5-isoquinolyl, 6-isoquinolyl, 7-isoquinolyl, 8-isoquinolyl), benzol[b]furanyl (2-benzol[b]furanyl, 3-benzol[b]furanyl, 4-benzol[b]furanyl, 5-benzol[b]furanyl, 6-benzol[b]furanyl, 7-benzol[b]furanyl), 2,3-dihydro-benzol[b]furanyl (2-(2,3-dihydro-benzol[b]furanyl), 3-(2,3-dihydro-benzol[b]furanyl), 4-(2,3-dihydro-benzol[b]furanyl), 5-(2,3-dihydro-benzol[b]furanyl), 6-(2,3-dihydro-benzol[b]furanyl), 7-(2,3-dihydro-benzol[b]furanyl), benzol[b]thiophenyl, 5-benzol[b]thiophenyl (2-benzol[b]thiophenyl, 3-benzol[b]thiophenyl, 4-benzol[b]thiophenyl, 5-benzol[b]thiophenyl (2-(2,3-dihydro-benzol[b]thiophenyl), 3-(2,3-dihydro-benzol[b]thiophenyl), 4-(2,3-dihydro-benzol[b]thiophenyl), 5-(2,3-dihydro-benzol[b]thiophenyl), 6-(2,3-dihydro-benzol[b]thiophenyl), 7-(2,3-dihydro-benzol[b]thiophenyl), indolyl (1-indolyl, 2-indolyl, 3-indolyl, 4-indolyl, 5-indolyl, 6-indolyl, 7-indolyl), Indazole (1-indazolyl, 3-indazolyl, 4-indazolyl, 5-indazolyl, 6-indazolyl, 7-indazolyl), benzimidazolyl (1-benzimidazolyl, 2-benzimidazolyl, 4-benzimidazolyl, 5-benzimidazolyl, 6-benzimidazolyl, 7-benzimidazolyl, 8-benzimidazolyl), benzoxazolyl (1-benzoxazolyl, 2-benzoxazolyl), benzothiazolyl (1-benzothiazolyl, 2-benzothiazolyl, 4-benzothiazolyl, 5-benzothiazolyl, 6-benzothiazolyl, 7-benzothiazolyl), carbazolyl (1-carbazolyl, 2-carbazolyl, 3-carbazolyl, 4-carbazolyl), 5H-dibenz[b,f]azepine (5H-dibenz[b,f]azepin-1-yl, 5H-dibenz[b,f]azepin-2-yl, 5H-dibenz[b,f]azepine-3-yl, 5H-dibenz[b,f]azepine-4-yl, 5H-dibenz[b,f]azepine-5-yl), 10,11-dihydro-5H-dibenz[b,f]azepine (10,11-dihydro-5H-dibenz[b,f]azepine-1-yl, 10,11-dihydro-5H-dibenz[b,f]azepine-2-yl, 10,11-dihydro-5H-dibenz[b,f]azepine-3-yl, 10,11-dihydro-5H-dibenz[b,f]azepine-4-yl, 10,11-dihydro-5H-dibenz[b,f]azepine-5-yl).	6-10-15-20-25
2	The Functional Entity carries elements used to interact with host molecules and operationally reactive elements allowing further elaboration of an encoded molecule of a library. Interaction with host molecules like enzymes, receptors and polymers is typically mediated through van der waal's interactions, polar- and ionic interactions and pi-stacking effects. Substituents mediating said effects may be masked by methods known to an individual skilled in the art (Greene, T. W.; Wuts, P. G. M. <i>Protective Groups in Organic Synthesis</i> ; 3rd ed.; John Wiley & Sons: New York, 1999.) to avoid undesired interactions or reactions during the preparation of the individual	30

The Functional Entity carries elements used to interact with host molecules and operationally reactive elements allowing further elaboration of an encoded molecule of a library. Interaction with host molecules like enzymes, receptors and polymers is typically mediated through van der waals interactions, polar- and ionic interactions and pi-stacking effects. Substituents mediating said effects may be masked by methods known to an individual skilled in the art (Greens, T. W.; Wuts, P. G. M. *Protective Groups in Organic Synthesis*; 3rd ed.; John Wiley & Sons: New York, 1999.) to avoid undesired interactions or reactions during the preparation of the individual library, and during library synthesis. Analogously, reactive elements may be

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masked by suitably selected protection groups. It is appreciated by one skilled in the art that by suitable protection, a functional entity may carry a wide range of substituents.

5 The Functional Entity Precursor is a masked Functional Entity that is incorporated into an encoded molecule. After incorporation, reactive elements of the Functional Entity may be revealed by un-masking allowing further synthetic operations. Finally, elements mediating recognition of host molecules may be un-masked.

10 In a certain aspect of the invention, **Functional entity precursor** is $-C(H)(R^{11})-R^{11}$, or functional entity precursor is heteroaryl or aryl substituted with 0-3 R^{11} , 0-3 R^{13} and 0-3 R^{15} , wherein R^{11} and R^{11} are independently H, or selected among the group consisting of a C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkadienyl, C_3-C_7 cycloalkyl, C_3-C_7 cycloalkene- O , C_3-C_7 cycloalkenyl, aryl, and heteroaryl, said group being substituted with 0-3 R^{12} , 0-3 R^{13} and 0-3 R^{15} , or R^{11} and R^{11} are C_1-C_3 alkylene- NR^{12} , C_1-C_3 alkylene- $NR^{12}C(O)R^{16}$, C_1-C_3 alkylene- $NR^{12}C(O)R^{18}$, C_1-C_2 alkylene- $O-NR^{12}Z$, C_1-C_2 alkylene- $O-NR^{12}C(O)R^{16}$, C_1-C_2 alkylene- $O-NR^{12}C(O)R^{18}$ substituted with 0-3 R^{15} , where R^{12} is H or selected independently among the group consisting of C_1-C_6 alkyl, C_2-C_6 alkenyl, C_3-C_7 cycloalkyl, C_3-C_7 cycloalkene- O alkyl, aryl, heteroaryl, said group being substituted with 0-3 R^{13} and 0-3 R^{15} .

15 R^{13} is selected independently from N_3 , -CNO, -CNOH, -NH₂, -NH₂OH, -NHNR¹⁷, -C(O)R¹⁷, -SR¹⁷, -B(O)R¹⁷, -B(O)OR¹⁷, or the group consisting of C_2-C_6 alkyl, C_2-C_6 alkenyl, C_4-C_8 alkadienyl said group being substituted with 0-2 R^{14} , where R^{14} is independently selected from $-NO_2$, $-C(O)OR^{17}$, $-COR^{17}$, $-CN$, $-OSiR^{17}3$, $-OR^{17}$ and $-NR^{17}2$.

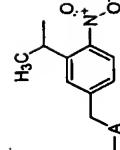
20 R^{15} is =O, F, -Cl, -Br, -I, -CN, -NO₂, -OR¹⁷, -NR¹⁷₂, -NR¹⁷-C(O)R¹⁸, -NR¹⁷-C(O)OR¹⁸, -SR¹⁷, -S(O)R¹⁷, -S(O)NR¹⁷₂ and $-S(O)NR^{17}2$, R^{16} is H, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_3-C_7 cycloalkyl, aryl or C_1-C_6 alkylene-aryl substituted with 0-3 substituents independently selected from $-F$, $-Cl$, $-NO_2$, $-R^2$, $-OR^2$, $-SiR^2_3$,

11 R^{17} is selected independently from H, C_1-C_6 alkyl, C_3-C_7 cycloalkyl, aryl, C_1-C_6 alkylene-aryl, C_2-C_6 alkenyl, C_3-C_7 cycloalkyl, aryl or C_1-C_6 alkylene-aryl and n is 1,2,3 or 4.

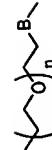


The S-C-connecting group provide a means for connecting the Spacer and the Carrier. As such it is primarily of synthetic convenience and does not influence the function of a building block.

- 5 The spacer serves to distance the functional entity precursor to be transferred from the bulky complementing element. Thus, when present, the identity of the spacer is not crucial for the function of the building block. It may be desired to have a spacer which can be cleaved by light. In this case, the spacer is provided with e.g. the group



In the event an increased hydrophilicity is desired the spacer may be provided with a polyethylene glycol part of the general formula:



In a preferred embodiment, the complementing element serves the function of transferring genetic information e.g. by recognising a coding element. The recognition implies that the two parts are capable of interacting in order to assemble a complementing element - coding element complex. In the biotechnological field a variety of interacting molecular parts are known which can be used according to the invention. Examples include, but are not restricted to protein-protein interactions, protein-polysaccharide interactions, RNA-protein interactions, DNA-DNA interactions, DNA-RNA interactions, RNA-RNA interactions, biotin-streptavidin interactions, enzyme-ligand interactions, antibody-ligand interaction, protein-ligand interaction, etc.

The interaction between the complementing element and coding element may result in a strong or a weak bonding. If a covalent bond is formed between the parties of the affinity pair the binding between the parts can be regarded as strong, whereas the establishment of hydrogen bondings, interactions between hydrophobic do-

means, and metal chelation in general results in weaker bonding. In general relatively weak bonding is preferred. In a preferred aspect of the invention, the complementing element is capable of reversible interacting with the coding element so as to provide for an attachment or detachment of the parts in accordance with the changing conditions of the media.

- 5 In a preferred aspect of the invention, the interaction is based on nucleotides, i.e. the complementing element is a nucleic acid. Preferably, the complementing element is a sequence of nucleotides and the coding element is a sequence of nucleotides capable of hybridising to the complementing element. The sequence of nucleotides carries a series of nucleobases on a backbone. The nucleobases may be any chemical entity able to be specifically recognized by a complementing entity. The nucleobases are usually selected from the natural nucleobases (adenine, guanine, uracil, thymine, and cytosine) but also the other nucleobases obeying the Watson-Crick hydrogen-bonding rules may be used, such as the synthetic nucleobases disclosed in US 6,037,120. Examples of natural and non-natural nucleobases able to perform a specific pairing are shown in figure 2. The backbone of the sequence of nucleotides may be any backbone able to aggregate the nucleobases is a sequence. Examples of backbones are shown in figure 4. In some aspects of the invention the addition of non-specific nucleobases to the complementing element is advantageous, figure 3
- 10 The coding element can be an oligonucleotide having nucleobases which complement and is specifically recognised by the complementing element, i.e. in the event the complementing element contains cytosine, the coding element part contains guanine and visa versa, and in the event the complementing element contains thymine or uracil the coding element contains adenine.
- 15 The complementing element may be a single nucleobase. In the generation of a library, this will allow for the incorporation of four different functional entities into the template-directed molecule. However, to obtain a higher diversity a complementing element preferably comprises at least two and more preferred at least three nucleotides. Theoretically, this will provide for 4² and 4³, respectively, different functional entities uniquely identified by the complementing element. The complementing element will usually not comprise more than 100 nucleotides. It is preferred to have complementing elements with a sequence of 3 to 30 nucleotides.

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The building blocks of the present invention can be used in a method for transferring a functional entity precursor to a recipient reactive group, said method comprising the steps of

5 providing one or more building blocks as described above and contacting the one or more building blocks with a corresponding encoding element associated with a recipient reactive group under conditions which allow for a

10 recognition between the one or more complementing elements and the encoding elements, said contacting being performed prior to, simultaneously with, or subsequent to a transfer of the functional entity precursor to the recipient reactive group.

The encoding element may comprise one, two, three or more codons, i.e. sequences that may be specifically recognised by a complementing element. Each of the codons may be separated by a suitable spacer group. Preferably, all or at least a majority of the codons of the template are arranged in sequence and each of the codons are separated from a neighbouring codon by a spacer group. Generally, it is preferred to have more than two codons on the template to allow for the synthesis of more complex encoded molecules. In a preferred aspect of the invention the number of codons of the encoding element is 2 to 100. Still more preferred are encoding elements comprising 3 to 10 codons. In another aspect, a codon comprises 1 to 50 nucleotides and the complementing element comprises a sequence of nucleotides complementary to one or more of the encoding sequences.

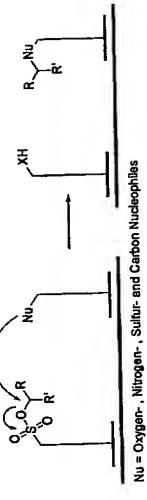
The recipient reactive group may be associated with the encoding element in any appropriate way. Thus, the reactive group may be associated covalently or non-covalently to the encoding element. In one embodiment the recipient reactive group is linked covalently to the encoding element through a suitable linker which may be separately cleavable to release the reaction product. In another embodiment, the reactive group is coupled to a complementing element, which is capable of recognising a sequence of nucleotides on the encoding element, whereby the recipient reactive group becomes attached to the encoding element by hybridisation. Also, the recipient reactive group may be part of a chemical scaffold, i.e. a chemical entity having one or more reactive groups available for receiving a functional entity precursor from a building block.

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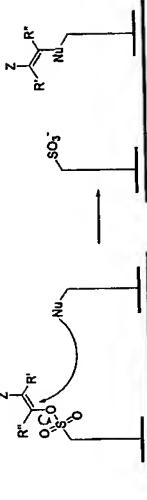
The recipient reactive group may be any group able to participate in cleaving the bond between the carrier and the functional entity precursor to release the functional entity precursor. Typically, the recipient reactive group is a nucleophilic atom such as S, N, O, C or P. Scheme 1a shows the transfer of an alkyl group and scheme 1b shows the transfer of an vinyl group.

Scheme 1a



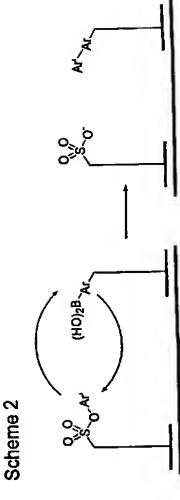
Nu = Oxygen-, Nitrogen-, Sulfur- and Carbon Nucleophiles

Scheme 1b

Z = Cl, COOR, COR, NO2, SO2R, Si=OR, SO2NR2, F
Nu = Oxygen-, Nitrogen-, Sulfur- and Carbon Nucleophiles

Alternatively, the recipient reactive group is a organometallic compound as shown in

Scheme 2.



According to a preferred aspect of the invention the building blocks are used for the formation of a library of compounds. The complementing element of the building block is used to identify the functional entity. Due to the enhanced proximity between reactive groups when the complementing entity and the encoding element are

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contacted, the functional entity precursor together with the identity programmed in the complementing element is transferred to the encoding element associated with the recipient reactive group. Thus, it is preferred that the sequence of the complementing element is unique in the sense that the same sequence is not used for another functional entity. The unique identification of the functional entity enable the possibility of decoding the encoding element in order to determine the synthetic history of the molecule formed. In the event two or more functional entities have been transferred to a scaffold, not only the identity of the transferred functional entities can be determined. Also the sequence of reaction and the type of reaction involved can be determined by decoding the encoding element. Thus, according to a preferred embodiment of the invention, each different member of a library comprises a complementing element having a unique sequence of nucleotides, which identifies the functional entity.

Brief description of the drawings

Figure 1. Two setups for Functional Entity Transfer

Figure 2. Examples of specific base pairing

Figure 3. Example of non-specific base-pairing

Figure 4. Backbone examples

Figure 5 Three examples of building blocks

Detailed Description of the Invention

A building block of the present invention is characterized by its ability to transfer its functional entity precursor to a recipient reactive group. This is done by forming a new covalent bond between the recipient reactive group and cleaving the bond between the carrier moiety and the functional entity precursor of the building block.

Two setups for generalized functional entity precursor transfer from a building block are depicted in figure 1. In the first example, one complementing element of a building block recognizes a coding element carrying another functional entity precursor, hence bringing the functional entities in close proximity. This results in a reaction between functional entity precursor 1 and 2 forming a covalent bond between these concurrent with the cleavage of the bond between functional entity precursor 2 and its linker. In the second example, a template brings together two building blocks resulting in functional entity precursor transfer from one building block to the other.

Figure 5 illustrates three specific compounds according to the invention. For illustrative purposes the individual features used in the claims are indicated. The upper compound is an example of a building block wherein the linker is backbone attached at the 3'-position. The first part of the linker, i.e. the spacer, is an aliphatic chain ending in a nitrogen atom. The nitrogen atom bridges to the S-C-connecting group, which is an N-acylated arylmethylamine. The carrier attached to the left hand side 5 carbonyl group of the S-C-connecting group is a benzene ring holding the C-F Connecting group in the para position. The C-F Connecting group is a positively charged sulfur atom which is attached to the Functional Entity Precursor, in this case a benzyl group. When the building block is presented to a nucleophilic recipient reactive group, such an amine or a thiol, Functional Entity Precursor is transferred to benzylate the recipient reactive group.

10 The middle compound illustrates a 5'-attachment of a linker. The linker is linked through a phosphate group and extends into a three membered aliphatic chain. Through another phosphate group and a PEG linker the complementing element is linked via an amide bond to the Carrier. When the building block is presented to a nucleophile the Functional Entity Precursor is transferred resulting in an alkylation of the nucleophile.

15 The lower compound illustrates a nucleobase attachment of the linker. The linker attaches to the 5 position of a pyrimidine type nucleobase and extends through an α - β unsaturated N-methylated amide to the S-C-connecting group, which is a 4-amino methyl benzoic acid derivative. The functional entity precursor can be transferred to a nucleophilic recipient reactive group e.g. an amine or a thiol forming an allylic amine or thiol.

20 The lower compound illustrates a nucleobase attachment of the linker. The linker attaches to the 5 position of a pyrimidine type nucleobase and extends through an α - β unsaturated N-methylated amide to the S-C-connecting group, which is a 4-amino methyl benzoic acid derivative. The functional entity precursor can be transferred to a nucleophilic recipient reactive group e.g. an amine or a thiol forming an allylic amine or thiol.

25 According to the invention, the functional entity precursor is of the formula $-\text{C}(\text{H})(\text{R}^3)\text{R}^4$ or functional entity precursor is heteroaryl or aryl optionally substituted with one or more substituents belonging to the group comprising R^3 and R^4 . In a further preferred embodiment,

30 R^3 and R^4 independently is H, $\text{C}_1\text{-C}_6$ alkyl, $\text{C}_2\text{-C}_6$ alkenyl, $\text{C}_4\text{-C}_8$ alkynyl, $\text{C}_4\text{-C}_8$ alkenynyl, $\text{C}_5\text{-C}_7$ cycloalkyl, $\text{C}_3\text{-C}_7$ cycloalkenoxy, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of

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Sn(R⁵)R⁶R⁷, Sn(OR⁵)R⁶R⁷, Sn(B(OR⁵)R⁶, B(OR⁶)R⁵), halo-
en, CN, CNO, C(halogen)₃, =O, OR⁶, OC(=O)OR⁶, OC(=O)NR⁵R⁶, SR⁵,
S(=O)R⁶, S(=O)NR⁵R⁶, NO₂, N₃, NR⁵RR⁷, NR⁵OR⁶, NR⁵NR⁶R⁷,
NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, NC, P(=O)(OR⁵)OR⁶, P(=O)RRR⁷,
C(=O)OR⁶, C(=NR⁵)R⁶, C(=NR⁵)R⁶, C(=NNR⁵R⁶), C(=O)NR⁵R⁶,
C(=O)NR⁵OR⁶, C(=O)NR⁵NR⁶R⁷, C(=NR⁵)NR⁶R⁷, C(=NR⁵)NR⁶R⁷ or R⁸,
wherein,
R⁵, R⁶, R⁷ and R⁸ independently is H, C₁-C₆ alkyl, C₂-C₈ alkenyl, C₂-C₈ alkynyl, C₄-C₈
alkadienyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloheteroalkyl, aryl or heteroaryl and wherein
R⁵ and R⁶ may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may
together form a 3-8 membered heterocyclic ring or R⁸ and R⁷ may together form a 3-
8 membered heterocyclic ring,
in another preferred embodiment,
R³ and R⁴ independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloheteroalkyl),
aryl or heteroaryl, optionally substituted with one or more substituents selected from
the group consisting of halogen, CN, C(halogen)₃, =O, OR⁵, OC(=O)R⁵,
OC(=O)OR⁶, OC(=O)NR⁶R⁷, SR⁵, S(=O)R⁵, S(=O)OR⁶, S(=O)NR⁶R⁷,
NR⁵NR⁶R⁷, NR⁵C(=O)R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R⁷,
NR⁵OR⁶, C(=O)OR⁶, C(=O)NR⁵R⁶, C(=NR⁵)R⁶, C(=NNR⁵R⁶), C(=O)OR⁵,
C(=O)NR⁵OR⁶, C(=O)NR⁵NR⁶R⁷, C(=NR⁵)NR⁶R⁷, C(=NR⁵)NR⁶R⁷ or

wherein, R^5 , R^6 , R^7 and R^8 independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cyclohexa-alkyl, aryl or heteroaryl and wherein R^6 and R^8 may together form a 3-8 membered heterocyclic ring or R^6 and R^7 may together form a 3-8 membered heterocyclic ring.

in still another preferred embodiment, R^3 and R^4 independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloheteroalkyl, or heteroalkyl, optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, OC(=O)OR⁵, OC(=O)R⁵, OC(=O)R⁵, SR⁵, Si(=O)R⁵, S(=O)R⁵, S(=O)₂NR⁶, NO₂, NR⁶R⁶, OC(=O)NR⁶R⁶, NR⁶Cl=OOR⁶, NR⁶Cl=ONR⁶R⁶, NR⁶Cl=ONR⁶R⁶, R¹={O}R⁶, R²={O}R⁶, R³={O}R⁶, R⁴={O}R⁶.

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C(=O)R⁶, C(=NR⁵)R⁶, C(=NOR⁵)R⁶, C(=NNR⁵R⁶), C(=O)OR⁵, C(=O)NRR⁵R⁶, C(=O)NRR⁵R⁶, C(=O)NRR⁵R⁶R', C(=NOR⁵)NRR⁶R', C(=NOR⁵)NRR⁶R' or R⁸, wherein,
 R⁵, R⁶, R⁷ and R⁸ independently is H, C₁-C₈ alkyl, C₃-C₇ cycloalkyl, C₅-C₇ cycloalkyl, aryl or heteroaryl and wherein R⁶ and R⁸ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring.

wherein, R^5 , R^6 , R^7 and R^8 independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cyclohex-
eroalkyl, aryl or heteroaryl and wherein R^5 and R^6 may together form a 3-8 mem-
bered heterocyclic ring or R^6 and R^7 may together form a 3-8 membered heterocyclic ring,
 R^5 or R^6 and R^7 may together form a 3-8 membered heterocyclic ring.

R^3 and R^4 independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloheteroalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, OC(=O)R⁵, OC(=O)OR⁵, OC(=O)NR⁵R⁶, SR⁵, S(=O)R⁵, S(=O)R⁵R⁶, NO₂, NR⁵R⁶, NR⁵OR⁶, NR⁵NR⁶R⁷, NR⁵Cl=OOR⁶ NR⁵Cl=OOR⁶ NR⁵Cl=ONR⁶R⁷, P(=O)OR⁵R⁶.

SUSTAINABILITY

$C=(O)R^5$, $C=(NR^5)R^6$, $C=(NOR^5)R^6$, $C=(NHR^5)R^6$, $C=(O)OR^6$, $C=(O)NR^5R^6$,
 $C=(O)NR^6OR^6$, $C=(O)NR^5NR^6R^7$, $C=(NR^5)NR^6R^7$, $C=(NOR^5)NR^6R^7$ or R^8 ,
wherein,
 R^6 , R^7 and R^8 independently is H, C_1-C_6 alkyl, C_3-C_7 cyclohexyl, C_3-C_7 cyclohe-
t eroalkyl, aryl or heteroaryl and wherein R^6 and R^8 may together form a 3-8 mem-
bered heterocyclic ring or R^6 and R^7 may together form a 3-8 membered heterocyc-
lic ring or R^8 and R^7 may together form a 3-8 membered heterocyclic ring.

10 R³ and R⁴ independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloheteroalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, Si(=O)R⁶, Si(=O)₂NR⁵, NO₂, NR⁵R⁶, NR⁵C(=O)OR⁷, NR⁵C(=O)NR⁷R⁸, C(=O)R⁵, C(=O)NR⁵R⁸, C(=O)NR⁷R⁸, C(=O)NR⁵OR⁸ or R⁸, wherein, R⁵, R⁶, R⁷ and R⁸ independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cyclohet- eroalkyl, aryl or heteroaryl and wherein R⁵ and R⁶ may together form a 3-8 mem- bered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocy- lic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

15 in still another preferred embodiment,

20 R³ and R⁴ independently is H, methyl, ethyl, propyl, butyl, cyclohexyl, cycloheptyl

30 $\text{C}(\text{=O})\text{NR}^5\text{OR}^6$ or R^8 ,
wherein,
 R^5 , R^7 and R^8 independently is H, $\text{C}_1\text{-C}_8$ alkyl, $\text{C}_3\text{-C}_7$ cycloalkyl, $\text{C}_5\text{-C}_7$ cyclohet-
eroalkyl, aryl or heteroaryl and wherein R^5 and R^8 may together form a 3-8 mem-
bered heterocyclic ring or R^5 and R^7 may together form a 3-8 membered heterocyc-
lic ring or R^6 and R^7 may together form a 3-8 membered heterocyclic ring.

SUSTAINABILITY

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R^3 and R^4 independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)OR⁵, S(=O)OR⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R', S(=O)NR⁵R', NO₂, NR⁵R', NR⁵C(=O)R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R', C(=O)NR⁵R⁶, C(=O)OR⁵R⁶, C(=O)OR⁶, C(=O)NR⁵OR⁶, C(=O)NR⁶OR⁵, or R⁸, wherein,

R^5 , R^6 , R^7 and R^8 independently is H, C₁-C₈ alkyl, C₃-C₇ cyclohexyl, C₃-C₇ cyclohept- eralkyl, aryl or heteroaryl and wherein R^6 and R^8 may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

R^3 and R^4 independently is H, azidinyl, azetidinyl, pyrrolidinyl, piperidinyl or morpholinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)OR⁵, S(=O)NR⁵R', NO₂, NR⁵R', NR⁵C(=O)R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R', C(=O)R⁶, C(=O)NR⁵R', C(=O)OR⁵R', C(=O)NR⁵OR⁶, C(=O)OR⁶ or R⁸, wherein,

R^5 , R^6 , R^7 and R^8 independently is H, C₁-C₈ alkyl, C₃-C₇ cyclohexyl, C₃-C₇ cyclohept- eralkyl, aryl or heteroaryl and wherein R^6 and R^8 may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

R^3 and R^4 independently is H, phenyl, naphthyl, thienvyl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)OR⁵, S(=O)NR⁵R', NO₂, NR⁵R', NR⁵C(=O)R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R', C(=O)R⁶, C(=O)NR⁵R', C(=O)OR⁵R', C(=O)OR⁶, C(=O)NR⁵OR⁶ or R⁸, wherein,

R^5 , R^6 , R^7 and R^8 independently is H, C₁-C₈ alkyl, C₃-C₇ cyclohexyl, C₃-C₇ cyclohept- eralkyl, aryl or heteroaryl and wherein R^6 and R^8 may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

35

in still another preferred embodiment,

R^3 and R^4 independently is H, phenyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)OR⁵, S(=O)NR⁵R', NO₂, NR⁵R', NR⁵C(=O)R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R', C(=O)OR⁵R', C(=O)OR⁶, C(=O)NR⁵OR⁶ or R⁸, or R⁸, wherein,

R^5 , R^6 , R^7 and R^8 independently is H, C₁-C₈ alkyl, C₃-C₇ cyclohexyl, C₃-C₇ cyclohept- eralkyl, aryl or heteroaryl and wherein R^5 and R⁸ may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

R^3 and R^4 independently is H, thienvyl, furyl, pyridyl, quinolinyl or isoquinolinyl or eroleinyl, aryl or heteroaryl and wherein R^5 and R⁸ may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

R^3 and R^4 independently is H, thienvyl, furyl, pyridyl, quinolinyl or isoquinolinyl or eroleinyl, aryl or heteroaryl and wherein R^5 and R⁸ may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

R^3 and R^4 independently is H, thienvyl, furyl, pyridyl, quinolinyl or isoquinolinyl or eroleinyl, aryl or heteroaryl and wherein R^5 and R⁸ may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

R^3 and R^4 independently is H, thienvyl, furyl, pyridyl, quinolinyl or isoquinolinyl or eroleinyl, aryl or heteroaryl and wherein R^5 and R⁸ may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

R⁵ and R⁶ independently is H, azetidinyl, pyrrolidinyl, piperidinyl or morpholinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁶, S(=O)R⁵, S(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁶OR⁸, NR⁵R⁶, NR⁵C(=O)R⁸, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R⁷, NO₂, NR⁵R⁷, NR⁵C(=O)R⁸, C(=O)NR⁶OR⁸ or R⁸,

wherein,

R⁵, R⁶, R⁷ and R⁸ independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R⁶ and R⁸ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

15 in still another preferred embodiment,

R⁵ and R⁶ independently is H, phenyl, naphthyl, furyl, pyridinyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁶, S(=O)NR⁶R⁷, NO₂, NR⁵R⁶, NR⁵C(=O)R⁸, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁶, C(=O)NR⁵R⁸, C(=O)NR⁵OR⁶ or R⁸,

wherein,

R⁵, R⁶, R⁷ and R⁸ independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

15 in still another preferred embodiment,

R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl, naphthyl, furyl, pyridinyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁶, S(=O)NR⁶R⁷, NO₂, NR⁵R⁶, NR⁵C(=O)R⁸, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁶, C(=O)NR⁵R⁸, C(=O)NR⁵OR⁶ or R⁸,

wherein,

R⁵, R⁶, R⁷ and R⁸ independently is H, methyl, ethyl, propyl or butyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

20 in still another preferred embodiment,

R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl or naphthyl optionally substituted with one or

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wherein, R⁵, R⁶, R⁷ and R⁸ independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R⁶ and R⁸ may together form a 3-8 membered heterocyclic ring or R⁵ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

5 in still another preferred embodiment,

R³ and R⁴ independently is H, azetidinyl, pyrrolidinyl, piperidinyl or morpholinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁶, S(=O)NR⁶R⁷, NO₂, NR⁵R⁶, NR⁵C(=O)R⁸, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁵R⁸, C(=O)NR⁵OR⁶ or R⁸,

wherein,

R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring or R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring or R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring,

10 in still another preferred embodiment,

R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring or R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring or R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring,

15 in still another preferred embodiment,

R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring or R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring or R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring,

20 in still another preferred embodiment,

R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring or R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring or R³ and R⁴ independently is H, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl and wherein R⁵ and R⁸ may together form a 3-8 membered heterocyclic ring,

25 in still another preferred embodiment,

R³ and R⁴ independently is H, aziridinyl, azetidinyl, pyrrolidinyl, piperidinyl or morpholinyl optionally substituted with one or more substituents selected from the group

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consisting of F, Cl, CN, CF₃, =O, OR⁶, S(=O)R⁵, S(=O)R⁶, NR⁵R⁶, NO₂, NR⁶R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁶, C(=O)NR⁵OR⁶, C(=O)NR⁵OR⁶, C(=O)OR⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶, C(=O)NR⁵OR⁶, wherein,

5 R⁶, R⁷ and R⁸ independently is H, methyl, ethyl, propyl or butyl and wherein R⁶ and R⁸ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

10 in still another preferred embodiment,

R³ and R⁴ independently is H, phenyl, naphthyl, furyl, pyridyl, quinoliny or isoquinoliny optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)R⁶, NR⁵R⁶, NO₂, NR⁶R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶, C(=O)R⁶, C(=O)NR⁵R⁶, C(=O)OR⁵, C(=O)NR⁵OR⁶, C(=O)NR⁵OR⁶, wherein,

15 R⁶, R⁷ and R⁸ independently is H, methyl, ethyl, propyl or butyl and wherein R⁶ and R⁸ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

20 in still another preferred embodiment,

R³ and R⁴ independently is H, phenyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶, NO₂, NR⁶R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶, C(=O)R⁶, C(=O)NR⁵R⁶, C(=O)OR⁵, C(=O)NR⁵OR⁶, wherein,

25 R⁶, R⁷ and R⁸ independently is H, methyl, ethyl, propyl or butyl and wherein R⁶ and R⁸ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring or R⁶ and R⁷ may together form a 3-8 membered heterocyclic ring,

30 in still another preferred embodiment,

R³ and R⁴ independently is H, phenyl, naphthyl, furyl, pyridyl, quinoliny or isoquinoliny optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶, C(=O)R⁶, C(=O)NR⁵R⁶, C(=O)OR⁵, C(=O)NR⁵OR⁶, wherein,

35 R⁶, R⁷ and R⁸ independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl, in still another preferred embodiment,

30 in still another preferred embodiment,

R³ and R⁴ independently is phenyl, thiényl, furyl, pyridyl, quinoliny or isoquinoliny optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)OR⁶, NR⁵C(=O)NR⁶, C(=O)R⁶, C(=O)NR⁵R⁶, C(=O)OR⁵, C(=O)NR⁵OR⁶, wherein,

35 in still another preferred embodiment,

22

NO₂, NR⁵R⁶, NR⁵C(=O)R⁸, NR⁵C(=O)OR⁸, NR⁵C(=O)NR⁶R⁷, C(=O)OR⁵, C(=O)NR⁵R⁶, C(=O)OR⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

wherein,
5 R⁵, R⁶, R⁷ and R⁸ independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

in still another preferred embodiment,

R⁵ and R⁷ independently is phenyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)NR⁵R⁶, NO₂, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

or R⁸,

wherein,

R⁵, R⁶, R⁷ and R⁸ independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,
10 S(=O)R⁵, S(=O)R⁶, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

or R⁸,

wherein,
15 R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl, naphthyl, thienyl, furyl, pyridinyl, quinolinyl or isoquinolinyl,

wherein,

R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl, naphthyl, thienyl, furyl, pyridinyl, quinolinyl or isoquinolinyl,
20 S(=O)R⁵, S(=O)R⁶, S(=O)NR⁵R⁶, NO₂, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

or R⁸,

wherein,
25 R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl, naphthyl, thienyl, furyl, pyridinyl, quinolinyl or isoquinolinyl,
C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

wherein,

R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl, naphthyl, thienyl, furyl, pyridinyl, quinolinyl or isoquinolinyl,

wherein,
30 R⁵, R⁶, R⁷ and R⁸ independently is methyl, ethyl, propyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

or R⁸,

wherein,
35 R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl, naphthyl, thienyl, furyl, pyridinyl, quinolinyl or isoquinolinyl,

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in still another preferred embodiment,
R³ and R⁴ independently is azidinyl, azetidinyl, pyrrolidinyl, piperidinyl or morpholinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

wherein,

R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl, naphthyl, thienyl, furyl, pyridinyl, quinolinyl or isoquinolinyl,

in still another preferred embodiment,
R³ and R⁴ independently is phenyl, naphthyl, thienyl, furyl, pyridinyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

wherein,
5 R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl, naphthyl, thienyl, furyl, pyridinyl, quinolinyl or isoquinolinyl,

in still another preferred embodiment,
R³ and R⁴ independently is phenyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

wherein,
10 R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl or naphthyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

wherein,
15 R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl or naphthyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

wherein,
20 R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl or naphthyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

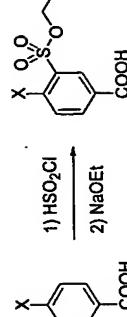
wherein,
25 R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl or naphthyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

wherein,
30 R⁵, R⁶, R⁷ and R⁸ independently is H, phenyl or naphthyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, =O, OR⁵, S(=O)R⁵, S(=O)NR⁵R⁶, NO₂, NR⁵R⁶, NR⁵C(=O)R⁶, NR⁵C(=O)NR⁶R⁷, C(=O)R⁵, C(=O)NR⁵R⁶, C(=O)NR⁵OR⁶ or R⁸,

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$\text{NR}^6\text{C}(\text{=O})\text{OR}^6$, $\text{NR}^6\text{C}(\text{=O})\text{NR}^6\text{R}^7$, $\text{C}(\text{=O})\text{NR}^6$, $\text{C}(\text{=O})\text{OR}^6$, $\text{C}(\text{=O})\text{NR}^6\text{R}^6$,
 $\text{C}(\text{=O})\text{NR}^6\text{OR}^6$ or R^6 ,

wherein,
 R^6 , R^6 , R^7 and R^8 independently is H, phenyl, naphthyl, thiényl, furyl, pyridinyl, quinolinyl or isoquinolinyl,

5 

in still another preferred embodiment,
 R^3 and R^4 independently is H, $\text{C}_1\text{-C}_6$ alkyl, $\text{C}_3\text{-C}_7$ cycloalkyl, $\text{C}_3\text{-C}_7$ cycloheteroalkyl, quinolinyl or heteroaryyl

10 in still another preferred embodiment,
 R^3 and R^4 independently is H,

in still another preferred embodiment,
 R^3 and R^4 independently is $\text{C}_1\text{-C}_6$ alkyl, $\text{C}_3\text{-C}_7$ cycloalkyl or $\text{C}_3\text{-C}_7$ cycloheteroalkyl,

15 in still another preferred embodiment,
 R^3 and R^4 independently is methyl, ethyl, propyl or butyl

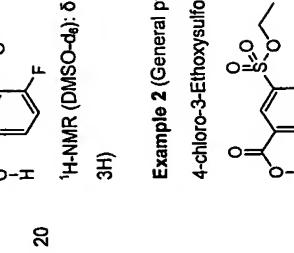
20 in still another preferred embodiment
 R^3 and R^4 independently is cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl

in still another preferred embodiment
 R^3 and R^4 independently is aziridinyl, pyrrolidinyl, piperidinyl or morpholinyl

25 in still another preferred embodiment,
 R^3 and R^4 independently is any or heteroaryyl

in still another preferred embodiment,
 R^3 and R^4 independently is phenyl or naphthyl

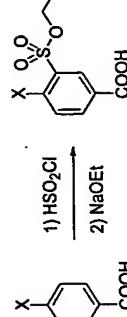
in still another preferred embodiment,
 R^3 and R^4 independently is thiényl, furyl, quinolinyl or isoquinolinyl

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Experimental section

General Procedure 1: Preparation of Carrier-F-Functional entity reagents:

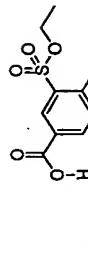


The 4-halobenzoic acid (25 mmol) is added to a ice cooled solution of chloro sulfonic acid (140 mmol). The mixture is slowly heated to reflux and left at reflux for 2-3 hours. The mixture is added to 100 mL ice and the precipitate collected by filtration.

10 The filtrate is washed with water (2 x 50 mL) and the dried *in vacuo* affording the corresponding sulfonyl chloride in 60-80% yield. The 3-chlorosulfonyl-4-halobenzoic acid derivative (5 mmol) is dissolved in EtOH (5 mL) and added to a ice cooled mixture of NaOEt (10 mL, 2M). The mixture is stirred *on* at rt. Acetic acid (40 mmol) is added and the mixture is evaporated *in vacuo*. Water (10 mL) is added and pH adjusted to pH = 2 (using 1M HCl). The product is extracted with DCM (2 x 25 mL), dried over Na_2SO_4 , and evaporated *in vacuo* affording the desired products.

Example 1 (General procedure (1))

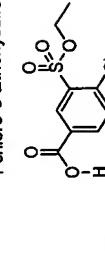
3-Ethoxysulfonyl-4-fluorobenzoic acid



¹H-NMR (DMSO-d₆): δ 8.49 (d, 1H), 7.85 (dd, 1H), 7.5 (d, 1H), 4.32 (q, 2H), 1.32 (t, 3H)

Example 2 (General procedure (1))

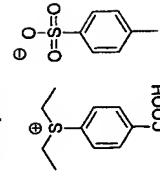
4-chloro-3-Ethoxysulfonylbenzoic acid



¹H-NMR (DMSO-d₆): δ 8.49 (d, 1H), 7.85 (dd, 1H), 7.5 (d, 1H), 4.32 (q, 2H), 1.32 (t, 3H)

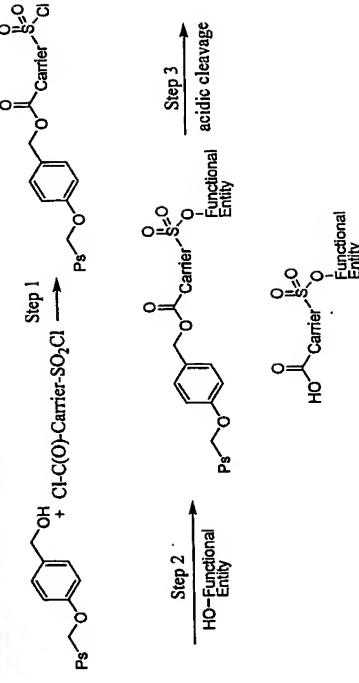
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Example 3

5 4-Methylsulfonylbenzoic acid (0.5g, 2.97 mmol, commercially available from Aldrich, cat no. 145521) was added to methyl p-toluene sulfonate (0.61g, 3.27 mmol). The mixture was heated to 140 °C for 1 hour in a sealed vessel. After cooling to rt the mixture was titrated with diethyl ether. Filtration and drying *in vacuo* yielded 844 mg (80%) of the desired product (>95% pure by ¹H nmr).

10 ¹H nmr (DMSO-d₆): 8.20-8.10 (m, 4H), 7.45 (d, 2H), 7.08 (d, 2H), 3.29 (s, 6H), 2.30 (s, 3H).

General Procedure 2: Solid phase preparation of Carrier-Functional entity reagents for alkylation building blocks:

Ps = Polystyrene resin. Alternatively other acid labile linkers may be employed.

Step 1:

20 A polystyrene resin with a wang linker (4-hydroxymethylphenol linker) (50 mg ~ 50 umol), a bi-functional carrier (200 umol, 4 equiv) in a solvent such as THF, DCM,

Step 2:

A functional entity precursor carrying a hydroxy group in the position of the intended attachment to the C-F-connecting group (200 umol, 4 equiv) in a solvent such as TEA,

10 THF, DCM, DCE, DMF, NMP or a mixture thereof (500 uL) and a base such as TEA, DIEA, pyridine (400 umol, 8 equiv), optionally in the presence of DMAP, are added to the resin bound carrier isolated in step 1 and allowed to react at temperatures between 0 °C and 100 °C, preferably between 25 °C and 80 °C, for 2-48 h, preferably 4-16 h. The resin is washed with the solvent composition used during the reaction (5x1 mL).

Step 3:

The desired Carrier-Functional entity reagent is cleaved from the resin obtained in step 2 by treatment with an acid like TFA, HF or HCl in a solvent such as THF, DCM, DCE or a mixture thereof (1 mL) at temperatures between -20 °C and 60 °C, preferably between 0 °C and 25 °C, for 1-4 h, preferably 1-2 h. Upon filtration, the resin is washed with the solvent composition used during cleavage (2x1 mL) and the combined filtrates are evaporated *in vacuo*. The isolated product may be purified by chromatography.

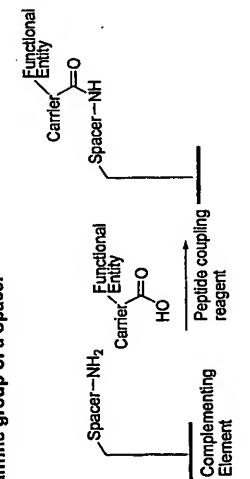
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Assembly of building blocks

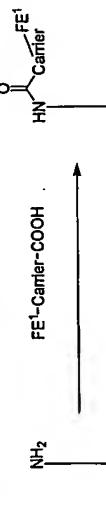
The Carrier-Functional entity reagent may be bound to the Spacer by several different reactions as illustrated below.

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Formation of an amide bond between a carboxylic acid of the Carrier and an amine group of a Spacer

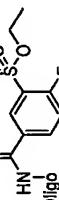


5 General Procedure 3: Preparation of building blocks by loading a Carrier-Functional entity reagent onto a nucleotide derivative comprising an amino group.



15 μ L of a 150 mM building block solution of FE¹-Carrier-COOH is mixed with 15 μ L of a 150 mM solution of EDC and 15 μ L of a 150 mM solution of N-hydroxysuccinimide (NHS) using solvents like DMF, DMSO, water, acetonitrile, THF, DCM, methanol, ethanol or a mixture thereof. The mixture is left for 15 min at 25°C. 45 μ L of an amino oligo (10 nmol) in 100 mM buffer at a pH between 5 and 10, preferably 6.0-7.5 is added and the reaction mixture is left for 2 hours at 25°C. Excess building block and organic by-products were removed by extraction with EtOAc (400 μ L). Remaining EtOAc is evaporated *in vacuo* using a speedvac. The building block is purified following elution through a BioRad micro-spin chromatography column, and analyzed by electron spray mass spectrometry (ES-MS).

20 Example 4 (General procedure (i))



Where Oligo is 5' XCG ATG GAT GCT CCA GGT CGC 3'; X = 5' amino C6 (Glen catalogue# 10-1906-90), Expected molecular weight: 6313.22

29

MS (calc.) = 6543.43; MS (found) = 6513.68*

* Observed molecular weight of the cleaved sulfonic ester: 6513.68 Expected molecular weight of the cleaved ester: 6514.37 The quantitative loss of the ethyl group is probably due to the presence of piperazine during the recording of the LC-MS data.

5 General Procedure 4: Loading of a carrier coupled functional entity onto an amino oligo:

25 μ L 100 mM carrier coupled functional entity dissolved in DMF (dimethyl formamide) was mixed with 25 μ L 100 mM EDC (1-ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride) in DMF for 30 minutes at 25°C. The mixture was added to 50 μ L amino oligo in H₂O with 100 mM HEPES (2-[4-(2-hydroxyethyl)-piperazin-1-yl]-ethanesulfonic acid) pH 7.5 and the reaction was allowed to proceed for 20 minutes at 25°C. Unreacted carrier coupled functional entity was removed by extraction with 500 μ L EtOAc (ethyl acetate), and the oligo was purified by gel filtration through a microspin column equilibrated with 100 mM MES (2-(N-morpholino) ethanesulfonic acid) pH 6.0.

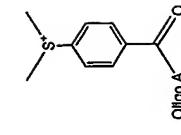
Oligonucleotide used:

Oligo A: 5'-YACGATGGATGCTCCAGGTGCG

Y = Amino modifier C6 (Glen# 10-1906)

20 Example 5 (General procedure 4)

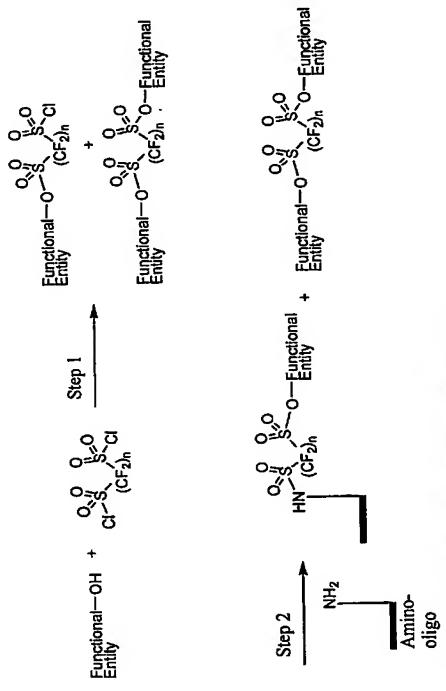
Carrier - Functional Entity: (4-Carboxy-phenyl)-dimethyl-sulfonium



25 Mass: 6789.21 (observed using ES-MS), 6790.65 (calculated)

General Procedure 5: Preparation of arylation building blocks:

30



- Step 1
- 5 To a solution of the bis-sulfonylchloride (Ward, R.B.; J. Org. Chem.; 30; 1965; 3009-3011; Qiu, Weiming; Button, Donald J.; Fluorine Chem.; 60; 1; 1993; 93-100) (3 umol) in DMF, DMSO, acetonitrile, THF or a mixture thereof (150 μL) is a phenolic functional entity in excess (1.05-1.8 mmol) in DMF, DMSO, acetonitrile, THF or a mixture thereof (150 μL) added slowly at temperatures between -20 °C and 100 °C preferably at 0-50 °C in the presence of a base such as TEA, DIEA, pyridine, NaHCO₃ or K₂CO₃.
- 10

Step 2

The reaction mixture from step 1 is added to a solution of an amino-oligo (10 nmol) in 100 mM buffer at a pH between 5 and 10, preferably 6.0-7.5 optionally in the presence of NHS. The reaction mixture is left for 2 hours at 25°C. Excess building block and organic by-products were removed by extraction with EtOAc (400 μL). Remaining EtOAc is evaporated *in vacuo* using a speedvac. The building amino-oligo is purified following elution through a BioRad micro-spin chromatography column, and analyzed by electron spray mass spectrometry (ES-MS).

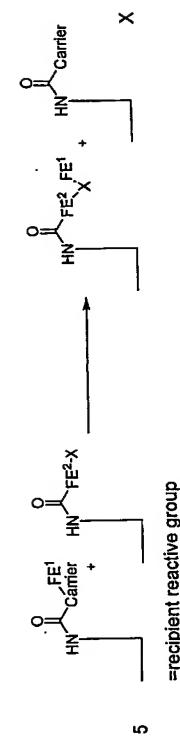
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Use of building blocks

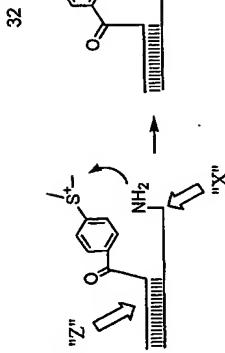
General Procedure 6: Alkylation of oligonucleotide derivatives containing a nucleophilic recipient group using a building block of the invention:



General procedure 7: Transfer of functional entity from a carrier oligo to recipient reactive group.

- 10 A carrier-coupled functional entity oligo (Example 1) (250 pmol) was added to a scaffold oligo B (200 pmol) in 50 μl 100 mM MES, pH 6. The mixture was incubated overnight at 25 °C. Subsequently, the mixture was purified by gel filtration using a microspin column equilibrated with H₂O and transfer of the functional entity was verified by electron spray mass spectrometry (ES-MS). Transfer efficiency is expressed in percent and were calculated by dividing the abundance of scaffold oligo carrying transferred functional entities to total abundance of scaffold oligos (with and without transferred functional entities).
- 15

30 Example 6 (General procedure 7)



Mass ("X"): 6583.97 (observed), 6583.31 (calculated). Abundance: 65.79 (arbitrary units)

5 Mass ("Y"): 6599.73 (observed), 6597.34 (calculated). Abundance: 29.23 (arbitrary units)

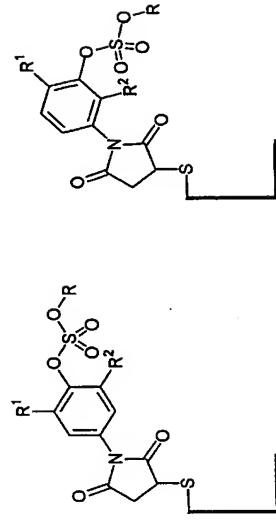
Mass ("Z"): 6789.36 (observed), 6780.65 (calculated)

10 Transfer efficiency calculated as: $29.23 / (29.23 + 65.79) = 0.3076 \sim 31\%$

- 15 General Procedure 8: Anylation of oligonucleotide derivatives containing a nucleophilic recipient group using a building block of the invention:
- 5
-
- X=recipient reactive group

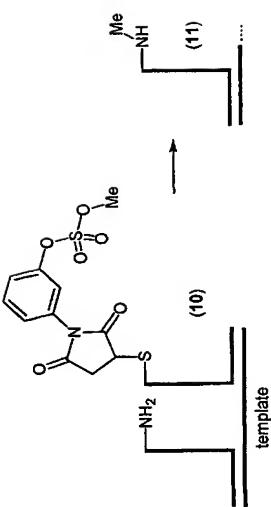
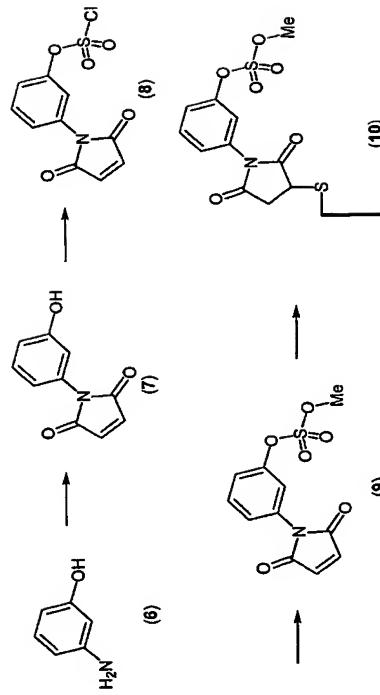
An oligonucleotide building block carrying functional entity FE¹' is combined at 2 μ M final concentration with one equivalent of a complementary building block displaying a nucleophilic recipient group. In the presence of a Pd catalyst, the reaction proceeds at temperatures between 0 °C and 100 °C preferably between 15 °C-50 °C for 1-48 hours, preferably 10-20 hours in DMF, DMSO, water, acetonitrile, THF, DCM, methanol, ethanol or a mixture thereof, pH buffered to 4-10, preferably 6-8. Organic by-products are removed by extraction with EtOAc, followed by evaporation of residual organic solvent for 10 min *in vacuo*. Pd catalyst is removed and oligonucleotides are isolated by eluting sample through a BioRad micro-spin chromatography column. Coupling efficiency is quantified by ES-MS analysis.

- 20 General Procedure 9: General route to the formation of alkylating/vinylating monomer building blocks with a thio-succinimid S-C-connecting group and use of these:



$R^1 = H, Me, Et, iPr, Cl, NO_2$
 $R^2 = H, Me, Et, iPr, Cl, NO_2$

R¹ and R² may be used to tune the reactivity of the sulphate to allow appropriate reactivity. Chloro and nitro substitution will increase reactivity. Alkyl groups will decrease reactivity. Ortho substituents to the sulphate will due to steric reasons direct incoming nucleophiles to attack the R-group selectively and avoid attack on sulphur. E.g.



10 3-Aminophenol (6) is treated with maleic anhydride, followed by treatment with an acid e.g. H₂SO₄ or P₂O₅ and heat to yield the maleimide (7). The ring closure to the maleimide may also be achieved when an acid stable O-protection group is used by treatment with or Ac₂O with or without heating, followed by O-deprotection. Alternatively reflux in Ac₂O, followed by O-deacetylation in hot water/dioxane to yield (7).

15

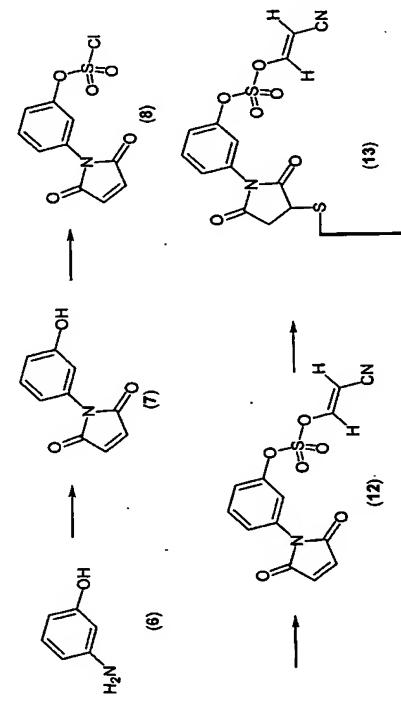
Further treatment of (7) with SO₂Cl₂ with or without triethylamine or potassium carbonate in dichloromethane or a higher boiling solvent will yield the intermediate (8), which may be isolated or directly further transformed into the aryl alkyl sulphate by the quench with the appropriate alcohol, in this case MeOH, whereby (9) will be formed. The organic building block (9) may be connected to an oligo nucleotide, as follows.

15 A thiol carrying oligonucleotide in buffer 50 mM MOPS or hepes or phosphate pH 7.5 is treated with a 1-100 mM solution and preferably 7.5 mM solution of the organic building block (9) in DMSO or alternatively DMF, such that the DMSO/DMF concentration is 5-50%, and preferably 10%. The mixture is left for 1-16 h and preferably 2-4 h at 25 °C. To give the alkylating in this case methylating monomer building block (10).

10 The reaction of the alkylating monomer building block (10) with an amine carrying monomer building block may be conducted as follows:

15 The coding oligonucleotide (1 nmol) is mixed with a thio oligonucleotide loaded with a building block (1 nmol) (10) and an amino-oligonucleotide (1 nmol) in hepes-buffer (20 µl of a 100 mM hepes and 1 M NaCl solution, pH=7.5) and water (39 µl). The oligonucleotides are annealed to the template by heating to 50 °C and cooled (2 °C/second) to 30 °C. The mixture is then left on at a fluctuating temperature (10 °C for 1 second then 35 °C for 1 second), to yield the template bound methylamine (11).

20 A vinylating monomer building block may be prepared and used similarly as described above for an alkylating monomer building block. Although instead of reacting the chlorosulphonate (8 above) with an alcohol, the intermediate chlorosulphate is isolated and treated with an enolate or O-trialkylsilylenolate with or without the presence of fluoride. E.g.



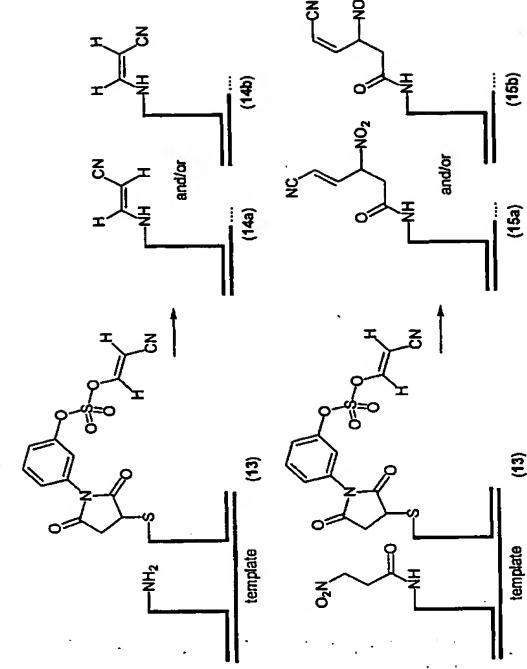
Formation of the vinylating monomer building block (13):

5 The thiol carrying oligonucleotide in buffer 50 mM MOPS or hepes or phosphate pH 7.5 is treated with a 1-100 mM solution and preferably 7.5 mM solution of the organic building block (12) in DMSO or alternatively DMF, such that the DMSO/DMF concentration is 5-50%, and preferably 10%. The mixture is left for 1-16 h and preferably 2-4 h at 25 °C. To give the vinylating monomer building block (13).

10 The sulfonylenolate (13) may be used to react with amine carrying monomer building block to give an enamine (14a and/or 14b) or e.g. react with an carbocation to yield (15a and/or 15b). E.g.

37

37



The reaction of the vinylating monomer building block (13) and an amine or nitro-

5 kyl carrying monomer building block may be conducted as follows:

The coding oligonucleotide (1 nmol) is mixed with a oligonucleotide building block (1 nmol) (13) and an amino-oligonucleotide (1 nmol) or nitroalkyl-oligonucleotide (1 nmol) (13) in 0.1 M TAPS, phosphate or hepes-buffer and 300 mM NaCl solution, pH=7.5-8.5 and preferably pH=8.5. The oligonucleotides are annealed to the template by heating to 50 °C and cooled (2 °C/ second) to 30 °C. The mixture is then left oil at a fluctuating temperature (10 °C for 1 second then 35 °C for 1 second), to yield template bound (14a/b or 15a/b).

15

Abbreviations

DCC	N,N'-Dicyclohexylcarbodiimide
DhbtOH	3,4-dihydro-3-hydroxy-4-oxo-1,2,3-benzotiazine
DIC	Diisopropylcarbodiimide
DIEA	Diethylisopropylamin
DMAP	4-Dimethylaminopyridine

DNA	Deoxyribonucleic Acid
EDC	1-Ethyl-3-(3'-dimethylaminopropyl)carbodiimide HCl
HATU	2-(1H-7-Azabenzotriazole-1-yl)-1,1,3,3-tetramethyluronium hexafluorophosphate
HBTU	2-(1H-Benzotriazole-1-yl)-1,1,3,3-tetramethyluronium hexafluorophosphate
HOAt	N-Hydroxy-7-azabenzotriazole
HOBt	N-Hydroxybenzotriazole
LNA	Locked Nucleic Acid
NHS	N-hydroxysuccinimid
OTf	Trifluoromethylsulfonate
OTs	Toluenesulfonate
PNA	Peptide Nucleic Acid
PyBOP	Benzotriazole-1-yl-oxy-tris-pyrididino-phosphonium hexafluorophosphate
PyBroP	Bromo-tris-pyrididino-phosphonium hexafluorophosphate
RNA	Ribonucleic acid
TBTU	2-(1H-Benzotriazole-1-yl)-1,1,3,3-tetramethyluronium tetrafluoroborate
TEA	Triethylamine
RP-HPLC	Reverse Phase High Performance Liquid Chromatography
TBDMs-Cl	Ter-Butyldimethylsilylchloride
5'-iodo-dU	5-iodo-deoxyriboseuracil
TLC	Thin layer chromatography
(BoC) ₂ O	Boc anhydride, di-tert-butyl dicarbonate
TBAF	Tetrabutylammonium fluoride
SPDP	Succinimidyl-propyl-2-dithiopyridyl

Claims

1. A building block of the general formula

Complementing Element – Linker – Carrier – C-F-connecting group – Functional entity precursor

5 capable of transferring a Functional entity precursor to a recipient reactive group, wherein

Complementing Element is a group identifying the Functional entity precursor,

Linker is a chemical moiety comprising a spacer and a S-C-connecting

10 group, wherein the spacer is a valence bond or a group distancing the Functional entity precursor to be transferred from the complementing element and the S-C-connecting group connects the spacer with the Carrier

Carrier is arylene, heteroarylene, C₁-C₆ alkenylene, C₁-C₆ alkylene, C₁-C₆ alkynylene, or -(CF₂)_m substituted with 0-3 R' wherein m is an integer between 1 and 10;

15 R' are independently selected from -H, -OR², -NR², -Halogen, -NO₂, -CN, -C(Halogen)₃, -C(O)R², -C(O)NHR², C(O)NR², -S(O)OR², -S(O)NHR², -S(O)NR², -S(O)₂R², -P(O)₂R², -P(O)R², -S(O)-R², -P(O)-OR², -S(O)-OR², -N(R²)₂, wherein R² is H, C₁-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl, or aryl,

20 C-F-connecting group is chosen from the group consisting of -SO₂Q-, -O-SO₂O-, -C(O)Q-, -S'(R³), -C-U-C(V)O-, -P'(W)O-, -P'(V)O-, where U is -C(R³)₂, -NR²- or -O-, V is =O or =NR² and W is -OR² or -N(R²)₂

Functional entity precursor is -C(H)(R³)-R⁴ or functional entity precursor is heteroaryl or aryl optionally substituted with one or more substituents belonging to the group comprising R³ and R⁴.

25 Wherein R³ and R⁴ independently is H, alkyl, alkenyl, alkynyl, alkadienyl, cycloalkyl, cycloheteroalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of SnR⁵R⁶R⁷, Si(OR⁵)²R⁷, Sn(OR⁵)(OR⁶)²R⁷, Br(OR⁵)²R⁷, Bi(OR⁵)²R⁷, halogen, CN, CNO, C(halogen)₃, Si(OR⁵)(OR⁶)R⁷, OR⁵, OC(=O)R⁵, OC(=O)OR⁵, OC(=O)R⁶, SR⁵, S(=O)R⁵, S(=O)OR⁵, S(=O)NR⁵R⁶, NO₂, N₃, NRR⁵, N⁵RR⁵R⁷, NR⁵OR⁶, NR⁵C(=O)R⁶, S(=O)NR⁵R⁶, NR⁵C(=O)NR⁶R⁷, NC, P(=O)(OR⁶)OR⁷, P'RR⁶R⁷, C(=O)R⁵,

30

wherein,

erocyclic ring, indole, in

2. A compound according to claim 1 wherein, **Functional entity precursor is** -C(H)(R¹¹)-R¹¹, or functional entity precursor is heteroaryl or aryl substituted with 0-3 R¹³-C(H)(R¹³)-R¹³ and 0-3 R¹⁵, wherein R¹¹ and R¹³, are independently H, or selected among the group consisting of a C₁-C₆ alkyl, C₂-C₈ alkenyl, C₂-C₆ alkynyl, C₄-C₆ alkadienyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloalkenyl, C₃-C₇ cycloalkadienyl, and heteroaryl, said group being substituted with 0-3 R¹², 0-3 R¹³

and $0-3 R^{15}$,
 or R^{11} and R^{11} , are C_1-C_3 alkylene- NR^{12} , C_1-C_3 alkylene- $NR^{12}C(O)R^{16}$, C_1-C_3 alkylene- $NR^{12}C(O)OR^{16}$, C_1-C_2 alkylene- NR^{12} , C_1-C_2 alkylene- $O-NR^{12}$, C_1-C_2 alkylene- $O-NR^{12}C(O)R^{16}$, C_1-C_2 alkylene- $O-NR^{12}C(O)OR^{16}$ substituted with $0-3 R^{15}$,
 where R^{12} is H or selected independently among the group consisting of C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_7 cycloalkyl, C_3-C_7 cycloheteroalkyl, aryl, heteroaryl, said group being substituted with $0-3 R^{13}$ and $0-3 R^{15}$,
 R^{13} is selected independently from $-N_3$, $-CNO$, $-C(NO)NH_2$, $-NH_2OH$, $-NHNR^{17}$, $-C(O)NR^{17}$, $-SnR^{17}_3$, $-B(O)R^{17}$, $-P(O)OR^{17}$, or the group consisting of

C_2-C_8 alkenyl, C_2-C_8 alkynyl, C_4-C_8 alkadienyl said group being substituted with 0-2 R^{14}

where R^{14} is independently selected from $-NO_2$, $-C(O)OR^{17}$, $-COR^{17}$, $-CN$,

$-\text{OSiR}^3_3$, $-\text{OR}^7$ and $-\text{NR}^{17}_2$;
 R^{15} is $=\text{O}$, $-\text{F}$, $-\text{Cl}$, $-\text{Br}$, $-\text{I}$, $-\text{CN}$, $-\text{NO}_2$, $-\text{OR}^{17}_2$, $-\text{NR}^{17}_2$, $-\text{C}(\text{O})\text{R}^{16}$,
 $-\text{NR}^{17}_2\text{C}(\text{O})\text{OR}^{18}$, $-\text{SR}^{17}_2$, $-\text{S}(\text{O})\text{R}^{17}_2$, $-\text{COOR}^{17}_2$, $-\text{S}(\text{O})_2\text{NR}^{17}_2$ and $-\text{S}(\text{O})_2\text{NR}^{17}_2$;
 R^{16} is H , $\text{C}_1\text{-C}_6$ alkyl, $\text{C}_2\text{-C}_6$ alkenyl, $\text{C}_2\text{-C}_6$ alkynyl, $\text{C}_3\text{-C}_7$ cycloalkyl, aryl or $\text{C}_1\text{-C}_6$ alkyl/ene-aryl substituted with 0-3 substituents independently selected from $-\text{F}$, $-\text{Cl}$,
 NO_2 , $-\text{R}^2$, $-\text{OR}^2$, $-\text{SiR}^2_3$,
 R^{17} is selected independently from H , $\text{C}_1\text{-C}_6$ alkyl, $\text{C}_3\text{-C}_7$ cycloalkyl, aryl, $\text{C}_1\text{-C}_6$ al-
 $\text{kylen}-\text{aryl}$, $\text{C}_1\text{-C}_6$ alkyl or $\text{C}_1\text{-C}_6$ alkyl and n is 1, 2, 3 or 4.

-C(H)(R¹¹)-R¹¹, or functional entity precursor is heteroaryl or aryl substituted with 0-5 R¹¹, 0-3 R¹³ and 0-3 R¹⁵, wherein R¹¹ and R¹¹ are independently H, or selected among the group consisting of a C₁-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl, C₃-C₈ alkadienyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloalkyl, aryl, and heteroaryl; said group being substituted with 0-3 R¹², 0-3 R¹³ and 0-3 R¹⁴, or a component consisting of

and $0-3 R^{15}$, or R^{11} and R^{11} , are C_1-C_3 alkylene- NR^{12} , C_1-C_3 alkylene- $NR^{12}C(O)R^{16}$, C_1-C_3 alkylene- $NR^{12}C(O)OR^{18}$, C_1-C_2 alkylene- NR^{12} , C_1-C_2 alkylene- $O-NR^{12}C(O)R^{18}$, C_1-C_2 alkylene- $NR^{12}C(O)OR^{18}$ substituted with $0-3 R^{15}$, where R^{12} is H or selected independently among the group consisting of C_1-C_6 , C_1-C_6 alkyl, C_1-C_6 alkenyl, C_1-C_6 alkynyl, C_1-C_6 cycloalkyl, C_1-C_6 cycloalkenyl and C_1-C_6 heterocycloalkyl, and C_1-C_6 carbocyclic, C_1-C_6 heterocyclic and C_1-C_6 carbocyclic-heterocyclic.

heteroaryl, said group being substituted with 0-3 R¹³ and 0-3 R¹⁵,
 R¹³ is selected independently from -N₃-, -CNO-, -C(NOH)NH₂, -NHNOH,
 -NHNHR¹⁷, -C(O)R¹⁷, -SnR¹⁷₃, -B(OR¹⁷)₂, F(O)(OR¹⁷)₂ or the group consisting of
 C₂-C₆ alkenyl, C₂-C₆ alkynyl, C₄-C₆ alkadienyl said group being substituted with 0-2
 R¹⁴,

which is incorporated in the structure of R^{15} and R^{16} :

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R^{16} is H , $C_1\text{-}C_6$ alkyl, $C_2\text{-}C_6$ alkenyl, $C_2\text{-}C_6$ alkynyl, $C_3\text{-}C_7$ cycloalkyl, aryl or $C_1\text{-}C_6$ alkylene-aryl substituted with 0-3 substituents independently selected from $-F$, $-Cl$, $-NO_2$, $-R^2$, $-OR^2$, $-SR^2$, wherein R^{17} is selected independently from H , $C_1\text{-}C_6$ alkyl, $C_3\text{-}C_7$ cycloalkyl, aryl, $C_1\text{-}C_6$ alkylene-aryl.

4. A compound according to claim 1 wherein, Functional entity precursor is

$-C(H)(R^{11})R^{11}$, wherein R^{11} and R^{11} are or $C_1\text{-}C_3$ alkylene- NR^{12} , $C_1\text{-}C_3$ alkynyl- $NR^{12}C(O)R^{16}$, $C_1\text{-}C_3$ alkylene- $NR^{12}C(O)OR^{16}$, $C_1\text{-}C_2$ alkylene- ONR^{12} , $C_1\text{-}C_2$ alkylene- $O-NR^{12}C(O)R^{16}$, $C_1\text{-}C_2$ alkylene- $O-NR^{12}C(O)OR^{16}$ substituted with 0-3 R^{16}

5. A compound according to claim 1 wherein, Functional entity precursor is

$-C(H)(R^{11})R^{11}$, wherein R^{11} and R^{11} are independently H , or selected among the group consisting of a $C_1\text{-}C_6$ alkyl, $C_2\text{-}C_6$ alkenyl, $C_2\text{-}C_6$ alkynyl, $C_3\text{-}C_7$ cycloalkyl, $C_3\text{-}C_8$ alkadienyl, $C_3\text{-}C_7$ cycloalkyl, aryl, and heteroaryl, said group being substituted with 0-3 R^{12} , 0-3 R^{13} and 0-3 R^{15} ,

6. A compound according to claim 2 wherein, Functional entity precursor is

$-C(H)(R^{11})R^{11}$, wherein R^{11} and R^{11} are independently H , or selected among the group consisting of a $C_1\text{-}C_6$ alkyl, $C_3\text{-}C_7$ cycloalkyl, $C_3\text{-}C_7$ cycloheteroalkyl, aryl, and heteroaryl, said group being substituted with 0-3 R^{12} and 0-3 R^{15} , where R^{12} is H or selected independently among the group consisting of $C_1\text{-}C_6$ alkyl, $C_2\text{-}C_6$ alkenyl, $C_2\text{-}C_6$ alkynyl, $C_3\text{-}C_7$ cycloalkyl, $C_3\text{-}C_7$ cycloheteroalkyl, aryl, heteroaryl.

R^{15} is $-O$, $-F$, $-Cl$, $-Br$, $-I$, $-CN$, $-NO_2$, $-OR^{17}$, $-NR^{17}C(O)R^{16}$, $-NR^{17}C(O)OR^{18}$, $-SR^{17}$, $-S(O)R^{17}$, $-S(O)NR^{17}$, $-COOR^{17}$, $-C(O)NR^{17}C(O)R^{16}$, $-C(O)NR^{17}C(O)OR^{18}$, $-C_1\text{-}C_6$ alkyl, $C_3\text{-}C_7$ cycloalkyl, aryl, or $C_1\text{-}C_6$ alkylene-aryl.

7. A compound according to claim 1 wherein, Functional entity precursor is heteroaryl or aryl substituted with 0-3 R^{11} , 0-3 R^{13} and 0-3

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8. A compound according to claim 2 wherein C-F-connecting group is chosen from the group consisting of $-SO_2\text{-}O$, $-O\text{-}SO_2\text{-}O$, $-C(O)\text{-}O$, $-S^*(R^{11})$, $-C\text{-}C(V)\text{-}O$, $-P^*(W)\text{-}O$, and $-P(W)\text{-}O$ where U is $-C(R^2)_2$, $-NR^2$ or $-O$; V is $=O$ or $=NR^2$ or $-N(R^2)_2$

5. A compound according to claim 2 wherein C-F-connecting group is $-S^*(R^{11})$,

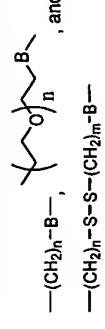
10. A compound according to claims 1 - 2 wherein C-F-connecting group is chosen from the group consisting of $-SO_2\text{-}O$, $-O\text{-}SO_2\text{-}O$, $-C(O)\text{-}O$, $-S^*(R^{17})$, $-C\text{-}C(V)\text{-}O$, $-P^*(W)\text{-}O$, and $-P(W)\text{-}O$ where U is $-C(R^2)_2$, $-NR^2$ or $-O$; V is $=O$ or $=NR^2$ and W is $-OR^2$ or $-N(R^2)_2$, wherein R^{17} is selected independently from H , $C_1\text{-}C_6$ alkyl, $C_3\text{-}C_7$ cycloalkyl, aryl, $C_1\text{-}C_6$ alkylene-aryl.

11. A compound according to claims 1 - 2 wherein C-F-connecting group is chosen from the group consisting of $-SO_2\text{-}O$, and $-S^*(R^{11})$; wherein R^{11} is selected independently from H , $C_1\text{-}C_6$ alkyl, $C_3\text{-}C_7$ cycloalkyl, aryl, $C_1\text{-}C_6$ alkylene-aryl.

12. A compound according to claim 1 wherein, Spacer is a valence bond, $C_1\text{-}C_6$ alkylene- A , $C_2\text{-}C_6$ alkenylene- A , $C_2\text{-}C_6$ alkynylene- A , or

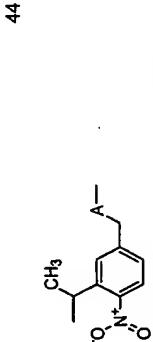
15. A compound according to claims 1 - 2 wherein, Spacer is a valence bond, $C_1\text{-}C_6$ alkylene- A , $C_2\text{-}C_6$ alkenylene- A , and $-S^*(R^{11})$; wherein R^{11} is selected independently from H , $C_1\text{-}C_6$ alkyl, $C_3\text{-}C_7$ cycloalkyl, aryl, $C_1\text{-}C_6$ alkylene-aryl.

20. A spacer optionally being connected through A to a linker selected from



25. where A is a valence bond, $-C(O)NR^{17}$, $-NR^{17}$, $-O$, $-S$, or $-C(O)\text{-}O$; B is a valence bond, $-O$, $-S$, $-NR^{17}$, or $-C(O)NR^{17}$ and connects to S-C-connecting group; and n and m independently are integers ranging from 1 to 10; and R^{17} is selected independently from H , $C_1\text{-}C_6$ alkyl, $C_3\text{-}C_7$ cycloalkyl, aryl, or $C_1\text{-}C_6$ alkylene-aryl

30. A compound according to claim 1 wherein, Spacer is a valence bond, $C_1\text{-}C_6$ alkylene- A , $C_2\text{-}C_6$ alkenylene- A , $C_2\text{-}C_6$ alkynylene- A , or

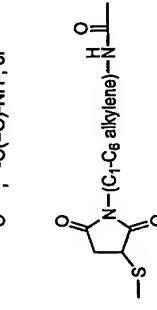
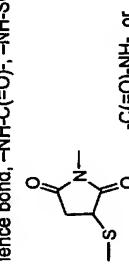
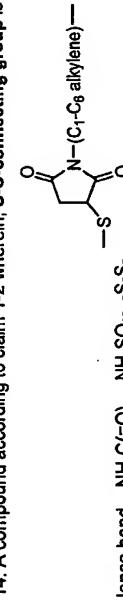


said spacer optionally being connected through A to a linker selected from



5 where A is a valence bond, -C(O)NR¹⁷-, -NR¹⁷-, -S-, or -C(O)-O-, B is -O-, -S-, -NR¹⁷-, or -C(O)NR¹⁷-, and connects to S-C-connecting group, and n and m independently are integers ranging from 1 to 6, and R¹⁷ is selected independently from H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, aryl, or C₁-C₆ alkylene-aryl

14. A compound according to claim 1-2 wherein, S-C-connecting group is a va-



15. A compound according to claim 2 wherein, the carrier is selected from the group consisting of anylene, heteroanylene or -(CF₂)_m substituted with 0-3 R¹ wherein m is an integer between 1 and 10, and C-F-connecting group is -SO₂-O-, and the functional entity precursor is -C(H)(R¹¹)-R¹¹.

20 16. A compound according to claim 2 wherein, the carrier is -(CE₂)_m wherein m is an integer between 1 and 10, the C-F-connecting group is -SO₂-O-, and the functional entity precursor is aryl or heteroaryl substituted with 0-3 R¹¹, 0-3 R¹³ and 0-3 R¹⁵.

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17. A compound according to claims 1-16 wherein Complementing element is a nucleic acid.

18. A compound according to claims 1-16 wherein Complementing element is a sequence of nucleotides selected from the group of DNA, RNA, LNA PNA, or morpholino derivatives.

5 19. A library of compounds according to claim 1, wherein each different member of the library comprises a complementing element having a unique sequence of nucleotides, which identifies the functional entity.

10 20. A method for transferring a functional entity precursor to a recipient reactive group, comprising the steps of providing one or more building blocks according to claims 1 to 18,

15 contacting the one or more building blocks with a corresponding encoding element associated with a recipient reactive group under conditions which allow for a recognition between the one or more complementing elements and the encoding elements, said contacting being performed prior to, simultaneously with, or subsequent to a transfer of the functional entity precursor to the recipient reactive group.

20 21. The method according to claim 20, wherein the encoding element comprises one or more encoding sequences comprised of 1 to 50 nucleotides and the one or more complementing element comprises a sequence of nucleotides complementary to one or more of the encoding sequences.

25 22. The method of claims 20 or 21, wherein the recipient reactive group is a nucleophilic S- or N- atom, which may be part of a chemical scaffold, and the activating catalyst is contains palladium.

Figure 1. Two setups for Functional Entity Transfer

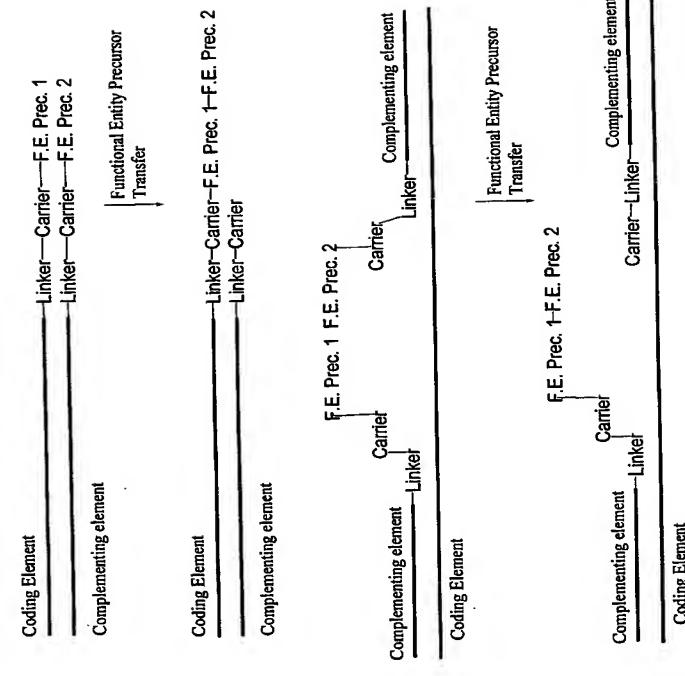


Figure 2. Examples of specific base pairing

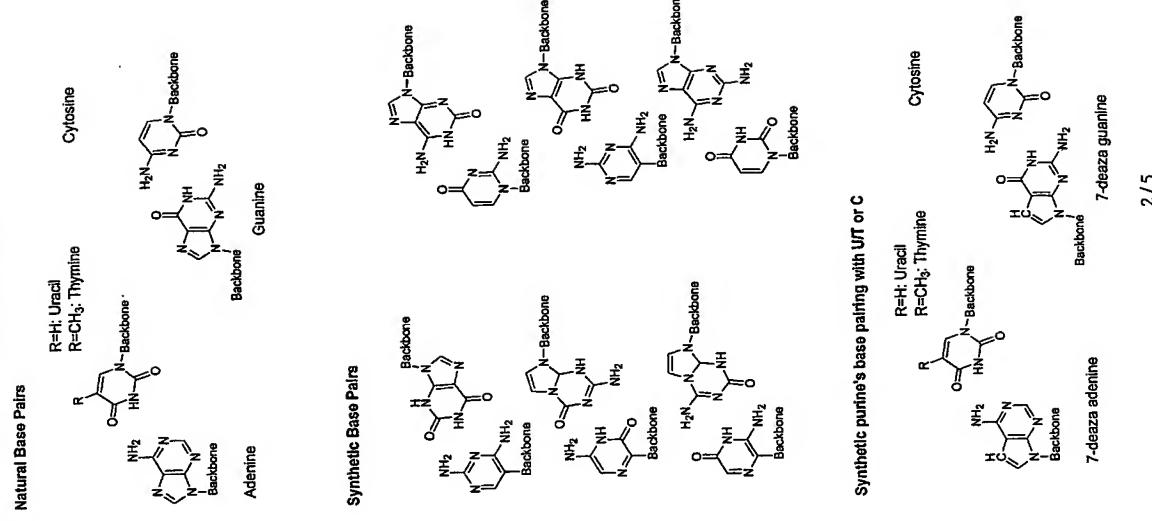


Figure 3. Example of non-specific base-pairing

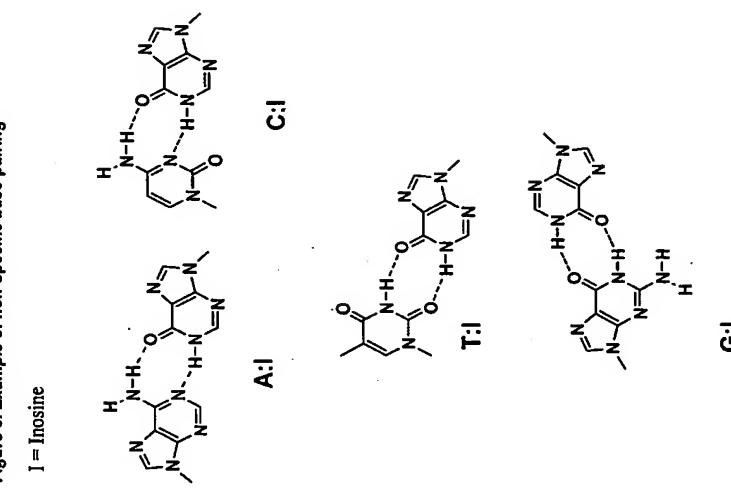
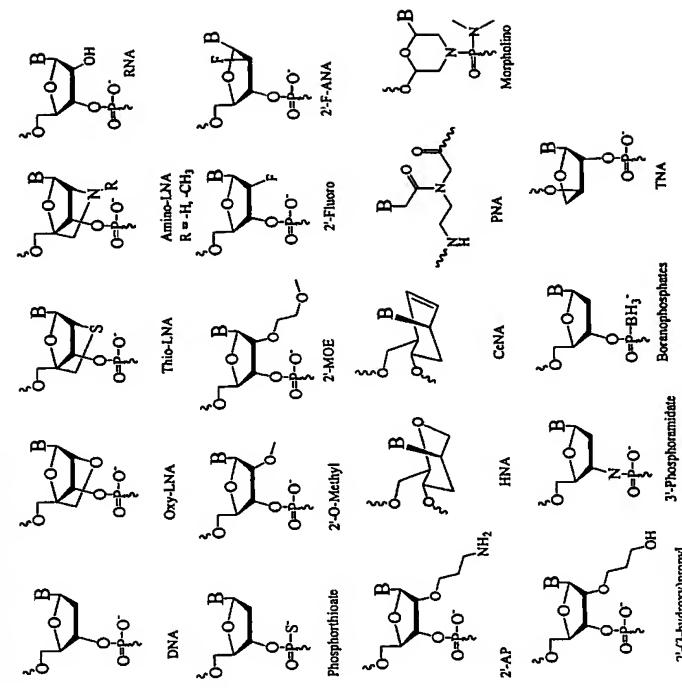
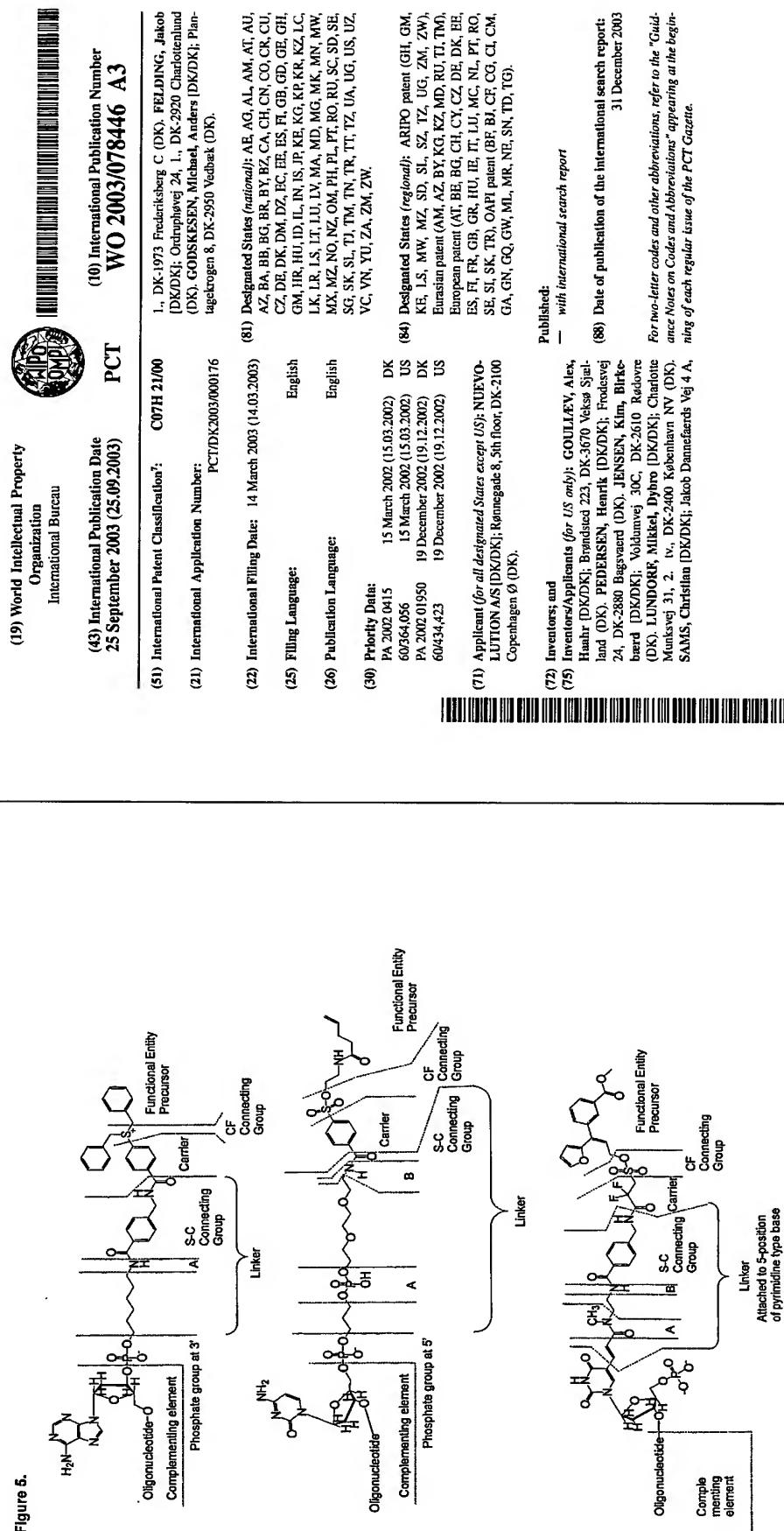


Figure 4. Backbone examples



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)



INTERNATIONAL SEARCH REPORT

International application No
PCT/DK 03/00176A CLASSIFICATION OF SUBJECT MATTER
IPC 7 C07H21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (Classification system followed by classification symbols)
IPC 7 C07H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 00 02895 A (THOMPSON ANDREW HUGIN ; BRAX GROUP LTD (GB) ; SCHMIDT GUENTER (GB);) 20 January 2000 (2000-01-20) the whole document	1

A Further documents are listed in the continuation of box C.

 Patent family numbers are listed in annex.

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- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubt on priority, claim(s) or which is cited to establish the publication date of another claim or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

Date of the actual completion of the International search

19 September 2003

Date of mailing of the International Search Report

06/10/2003

Authorized officer

de Nooy, A

X

X

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Form PCT/ISA2010 (continuation of second sheet) (Rev. 18/2002)

INTERNATIONAL SEARCH REPORT

International application No
PCT/DK 03/00176

C(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT	
Category	Citation of document, with indication, where appropriate, of the relevant passages
A	BRUCK R K ET AL: "TEMPLATE-DIRECTED LIGATION OF PEPTIDES TO OLIGONUCLEOTIDES" CHEMISTRY AND BIOLOGY, CURRENT BIOLOGY, LONDON, GB, vol. 3, no. 1, January 1996 (1996-01), pages 49-56, XP000856876 ISSN: 1074-5521 the whole document

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 03/00176

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. because they relate to subject matter not required to be searched by this Authority, namely:

2. 1-22 (in part) because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

Present claims 1-22 relate to an extremely large number of possible building blocks. In fact, the claims contain so many options that a lack of clarity within the meaning of Article 6 PCT arises to such an extent as to render a meaningful search of the claims impossible. Furthermore, support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT is to be found for only a very small proportion of the building blocks claimed. Consequently, the search has been carried out for those parts of the application which do appear to be clear, supported and disclosed, namely those parts related to the building blocks of claim 1 where the complementing element 1 is a nucleic acid or a derivative thereof as in claims 17 and 18 AND where the C-F connecting group is -S02-0- or -S+(R3)- with R3 defined in claim 1.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no International search report has been established need not be the subject of an International preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

International Application No. PCT/DK 03/00176

Continuation of Box 1.2

Claims Nos.:

1-22 (in part)

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

International Application No. PCT/DK 03/00176

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